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**Schreiber et al.**

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(54) **DRYER**

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**F26B 25/12** (2006.01)

**E05C 9/08** (2006.01)

**E05C 9/22** (2006.01)

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**E05C 9/22** (2013.01); **F26B 25/12** (2013.01)

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292/230, 231, 238, 198, 202–204, 210, 304,  
292/DIG. 69, DIG. 29, DIG. 32, 336.3;  
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70/5, 187, 196

See application file for complete search history.

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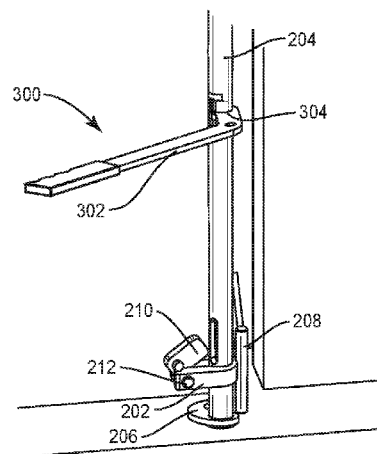
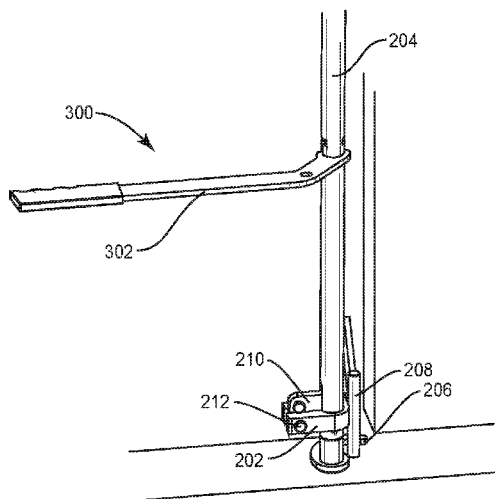
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(57)

**ABSTRACT**

A dryer for drying product includes a housing and a drying chamber formed in the housing. A series of doors are moveably mounted on the dryer for providing access to the drying chamber. A latch assembly is associated with each door for latching the door to the dryer. The latch assembly includes a bracket mounted to the door and a shaft rotatively mounted adjacent a portion of the bracket. The shaft includes a latch for engaging a latching catch and securing the door in the closed position. A locking member is pivotally mounted to the bracket and moveable between a locked and an unlocked position. In the locked position, the locking member extends into a locking cavity formed in the shaft.

**18 Claims, 10 Drawing Sheets**



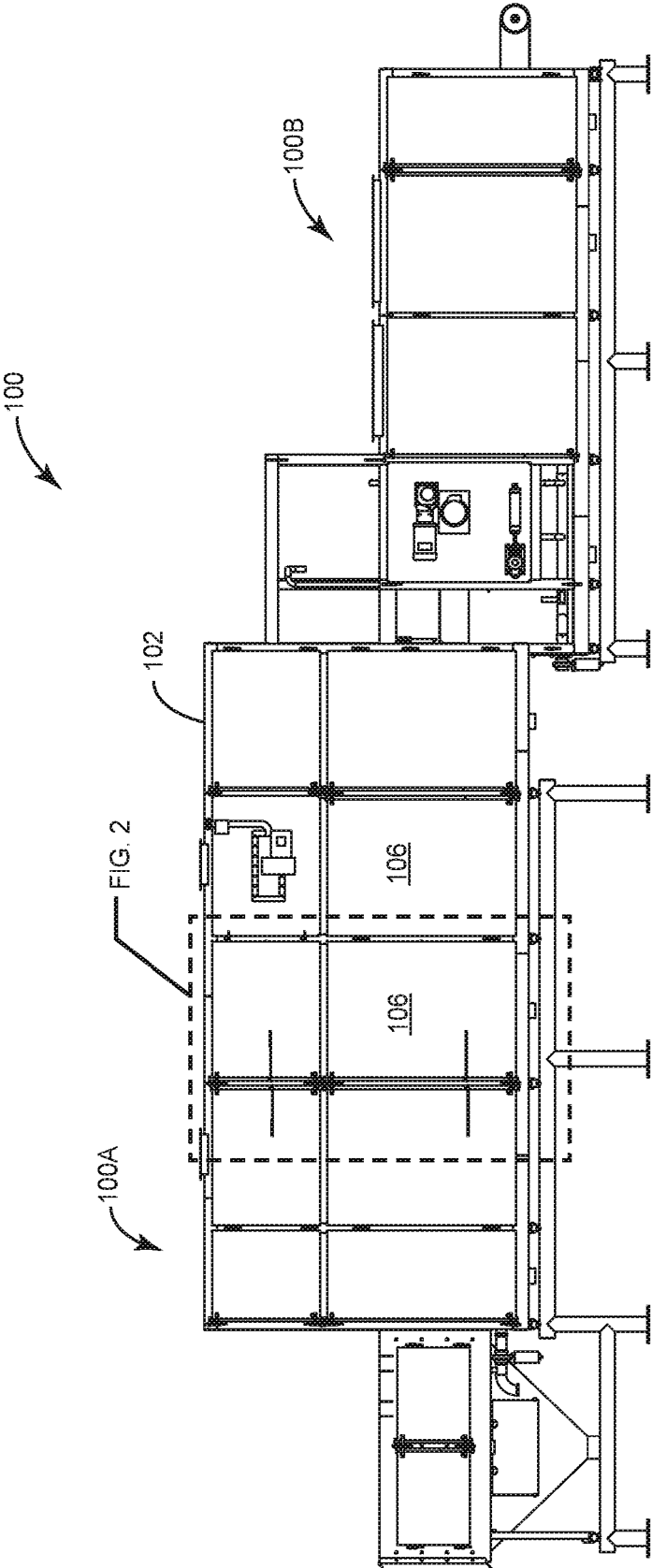


FIG. 1

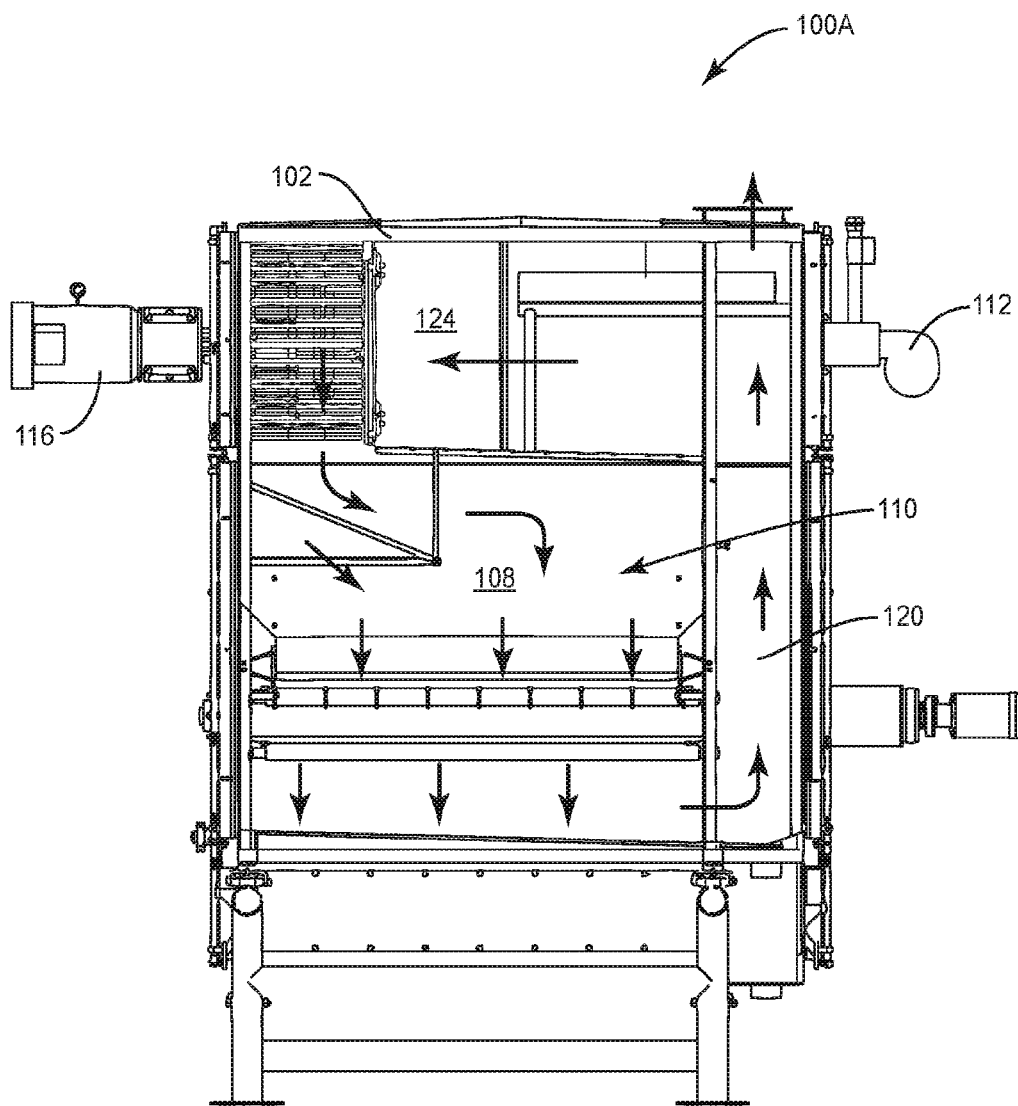


FIG. 1A

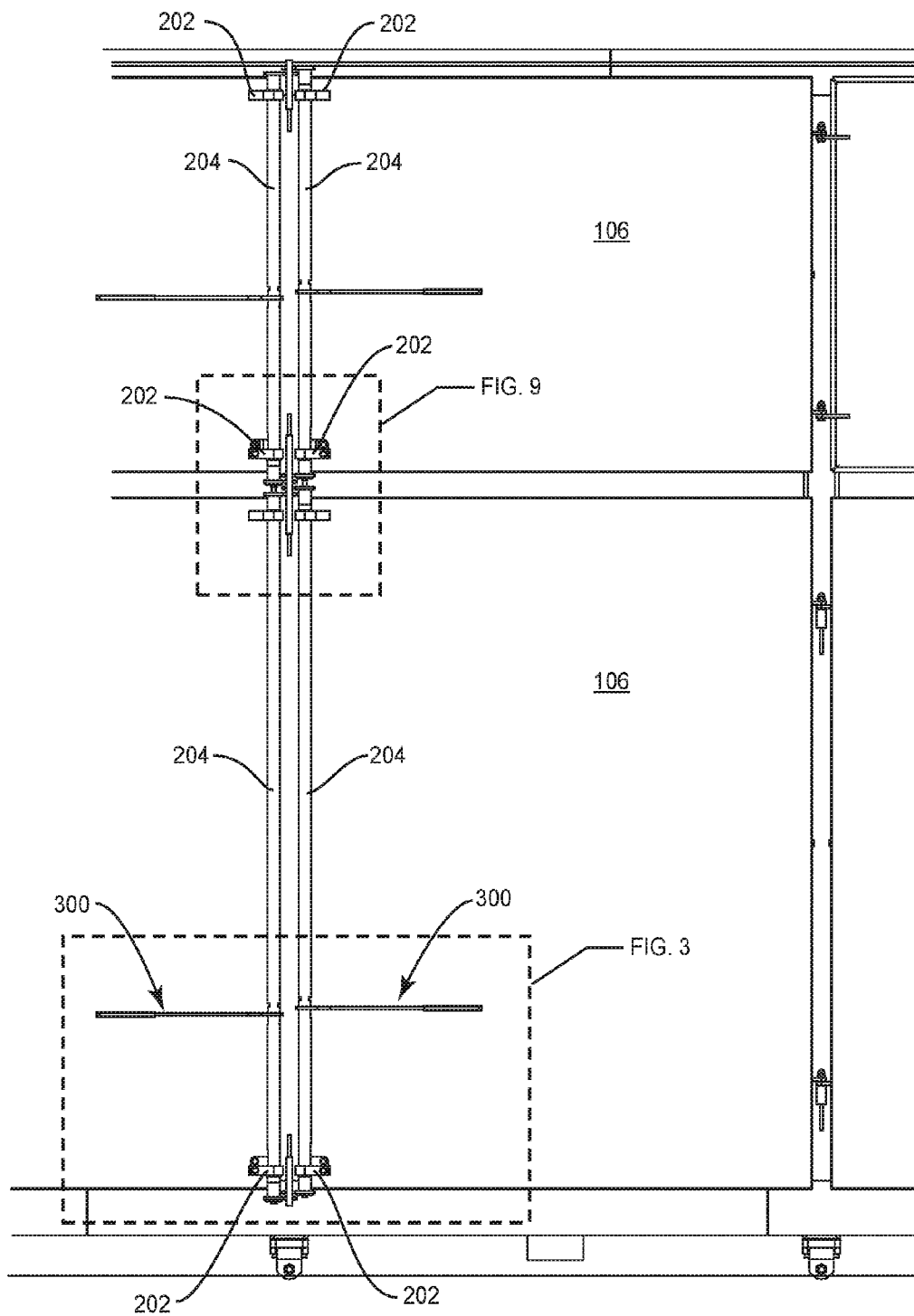
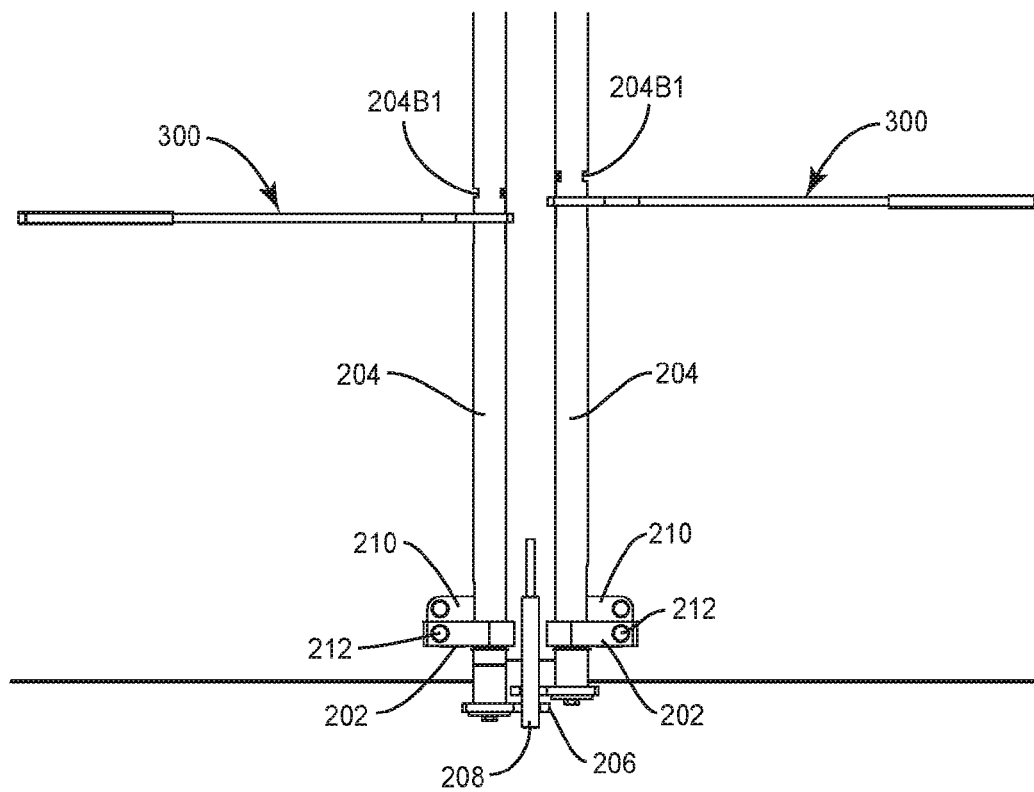
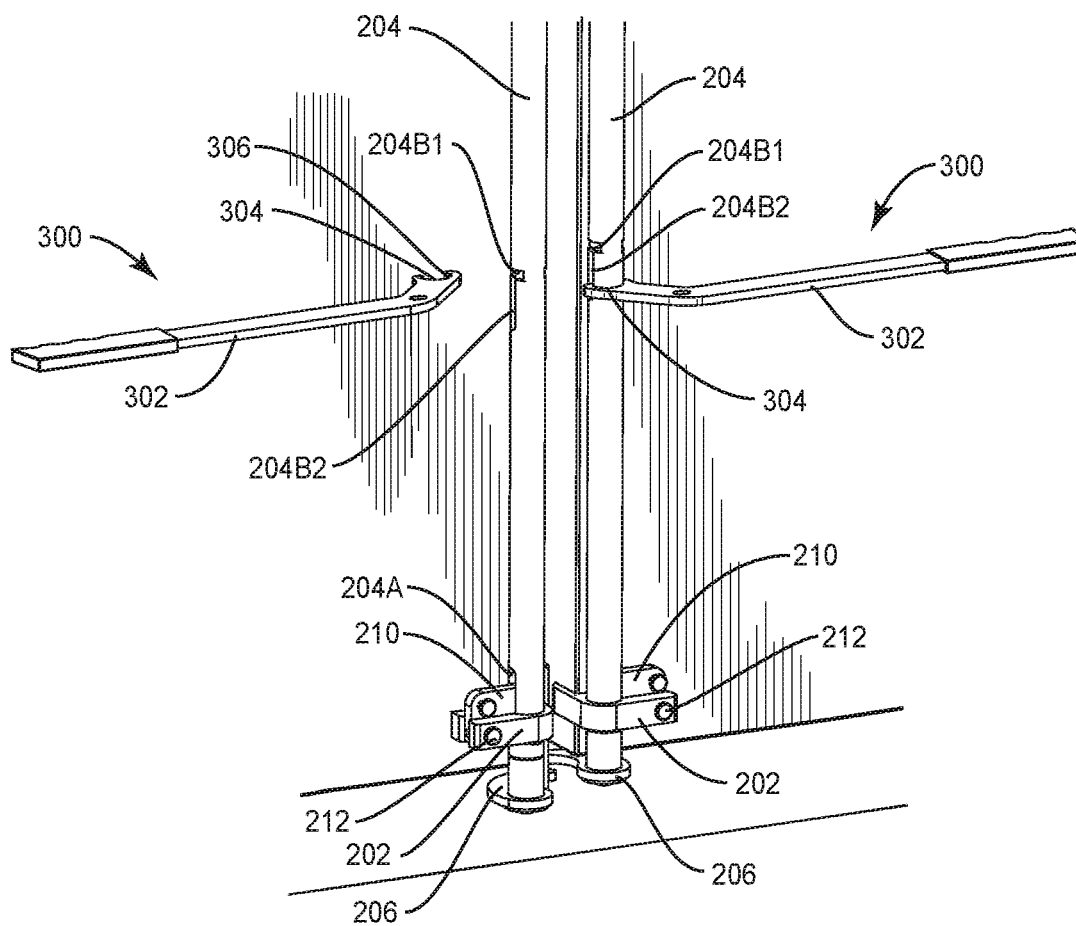


FIG. 2



**FIG. 3**



**FIG. 4**

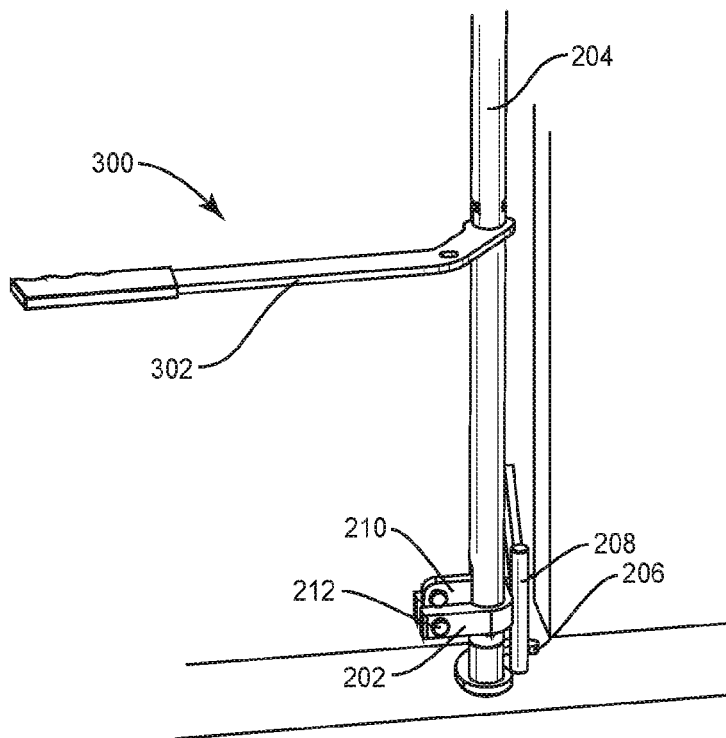


FIG. 5A

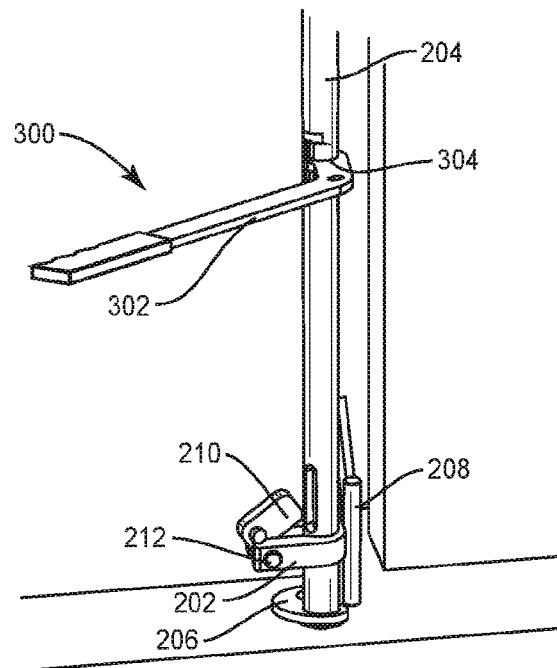
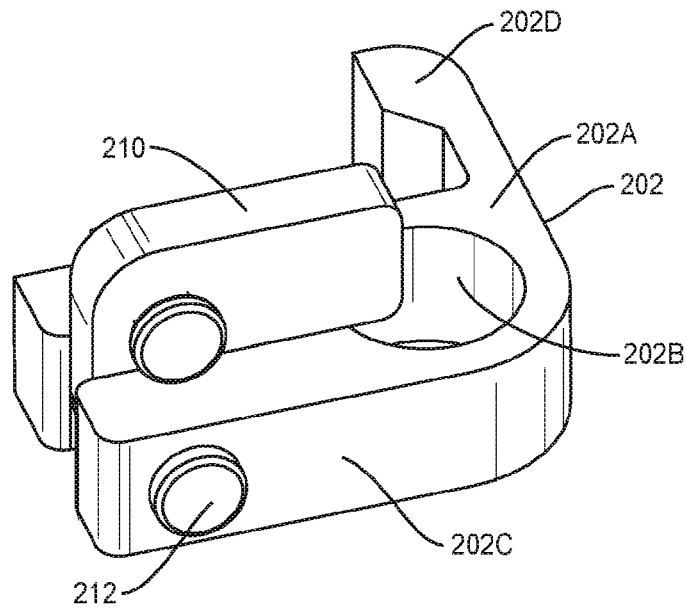
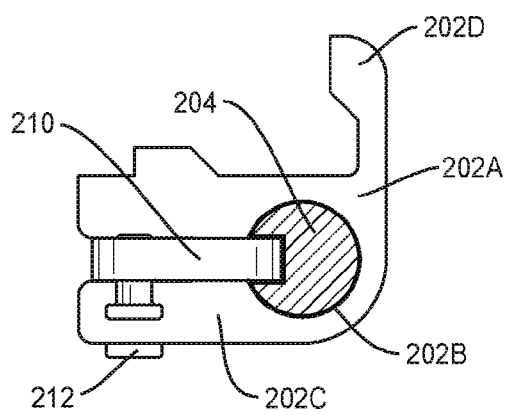


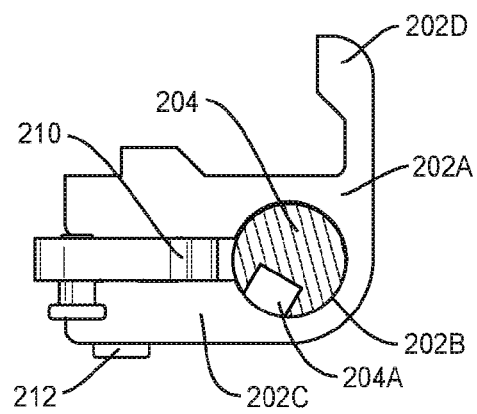
FIG. 5B



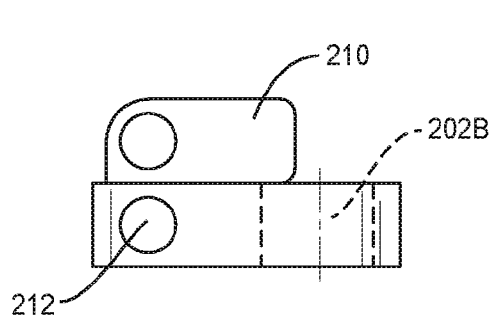
**FIG. 6**



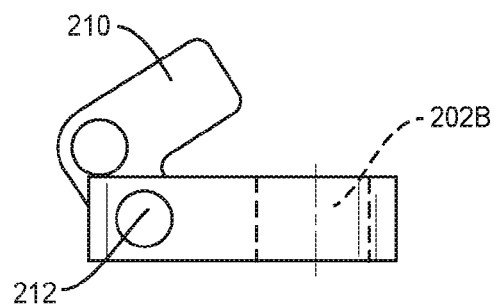
**FIG. 7A**



**FIG. 7B**



**FIG. 8A**



**FIG. 8B**



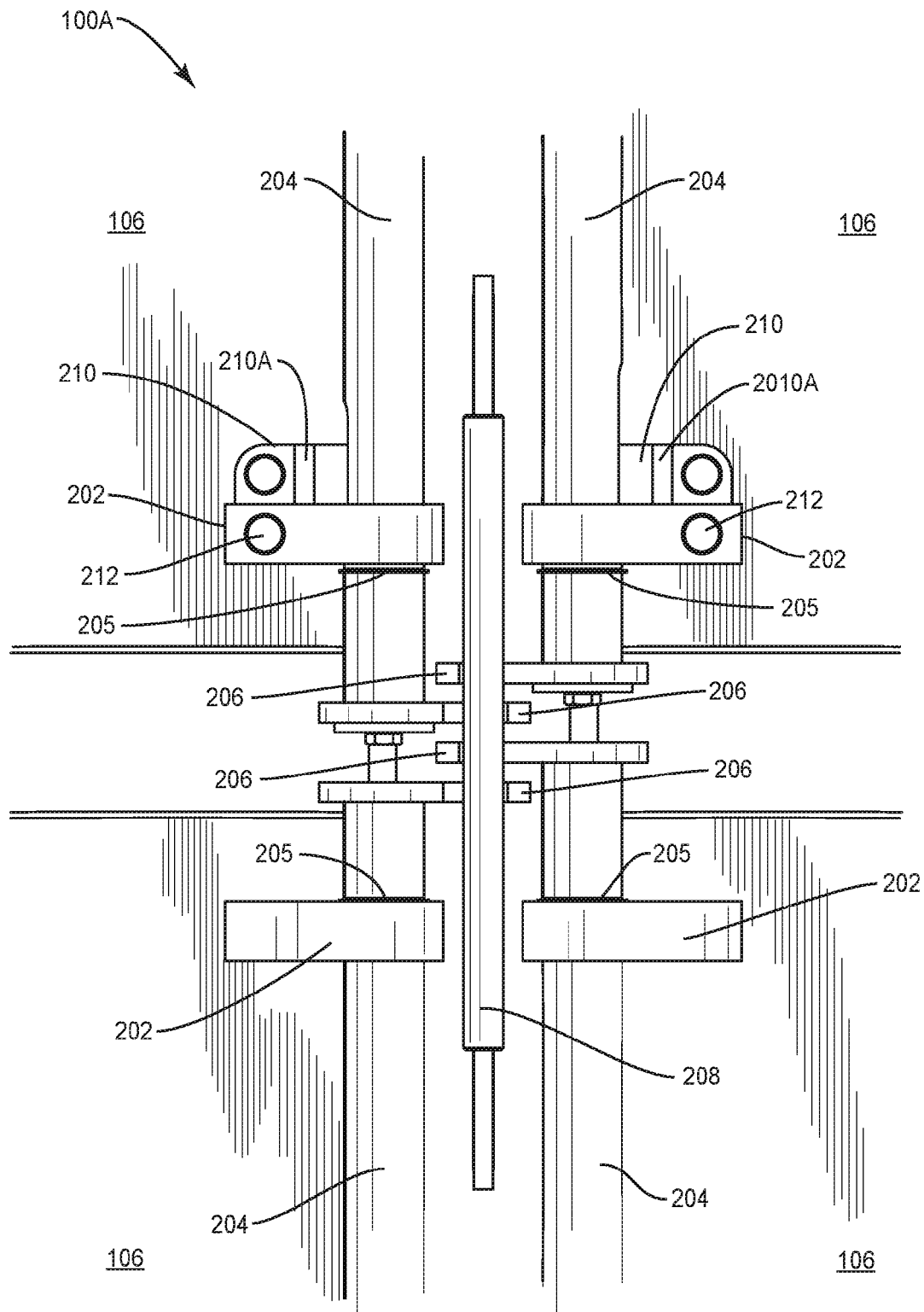
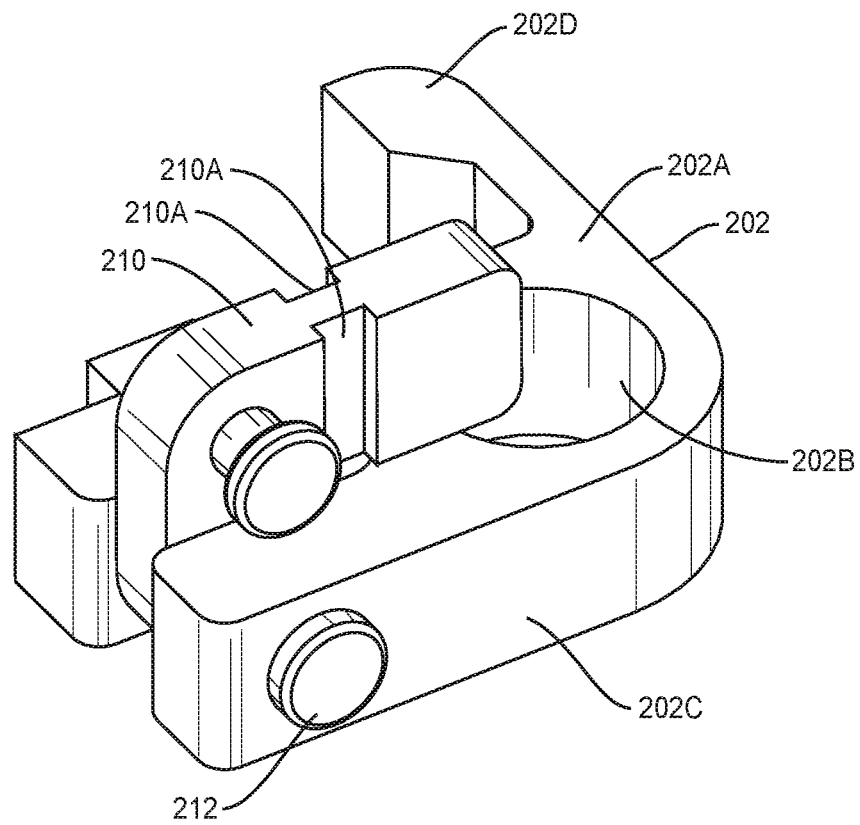
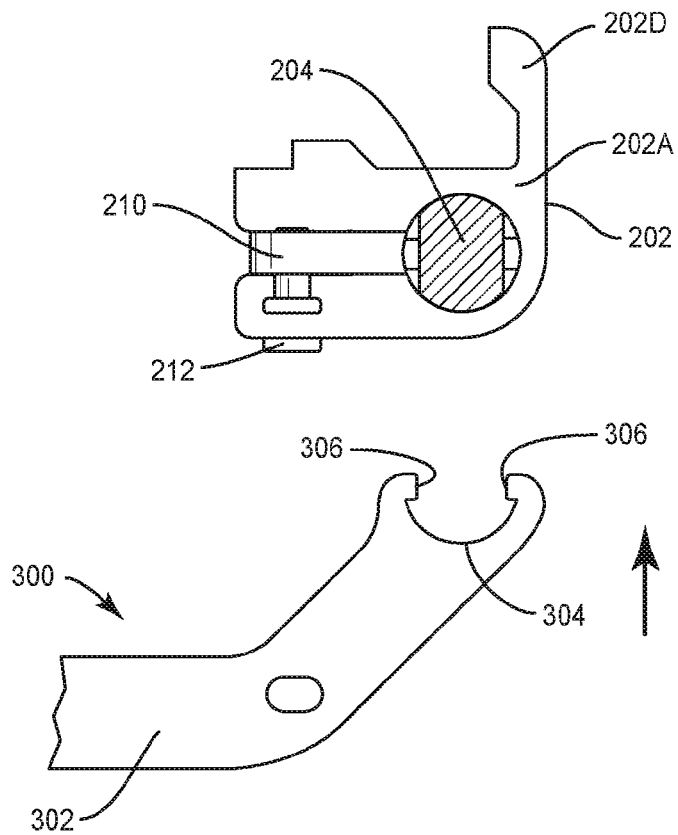


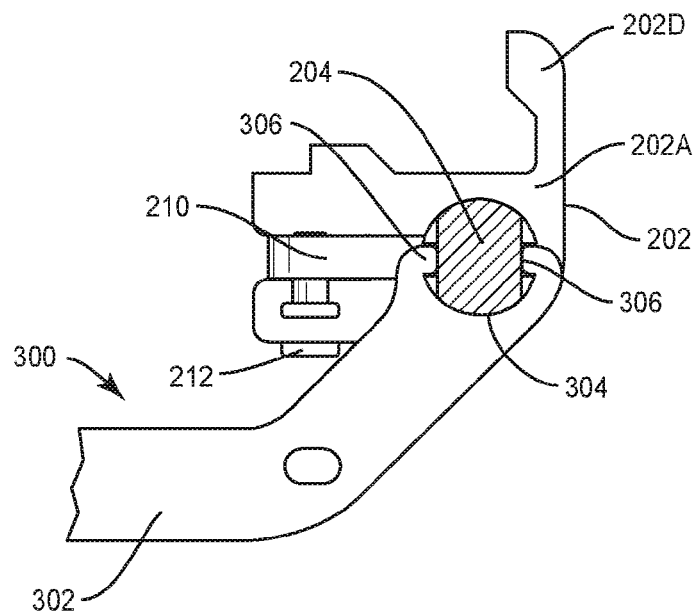
FIG. 9



**FIG. 10**



**FIG. 11A**



**FIG. 11B**

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**DRYER****FIELD OF THE INVENTION**

The present invention relates to commercial or industrial dryers.

**BACKGROUND OF THE INVENTION**

Industrial and commercial dryers are used globally to dry a wide variety of products, including food products. Today, one of the most challenging tasks facing manufacturers of dryers is that of addressing sanitation issues. This is, of course, especially true for dryers that are typically used for drying food products consumed by humans and animals.

To be sure, dryers must be designed to function, and to function efficiently. That alone does not always address sanitation requirements since sanitation issues are addressed in a number of ways. First, dryers are designed and engineered to minimize sanitation problems in general. This means that components are designed in a manner that minimize the collection of dust, debris and other matter that contributes to unsanitary conditions in and on the dryer. Moreover, components should be designed such that they can be easily and thoroughly cleaned. Here there is an emphasis on clean and simple designs that generally minimize the number of parts and minimizes cracks, crevices, and the like where matter can collect.

**SUMMARY OF THE INVENTION**

The present invention relates to commercial and industrial dryers having a series of doors for permitting access to a drying chamber formed in the dryer. One or more of the doors includes a latch assembly that is simply, effective, easy to clean and generally reduces sanitation risks.

In one particular embodiment, the latch assembly for at least one of the doors of the dryer includes a shaft that is rotatable in or adjacent a bracket that is mounted to the door. The shaft is rotatable between locked and unlocked positions. In the locked position, a latch extending from the bracket engages a latch catch and latches the door in a locked position. To lock the door, there is provided a locking member pivotally mounted to the bracket adjacent the shaft. The locking member is moveable between locked and unlocked positions. In the locked position, the locking member projects into a locking cavity formed in the shaft and this prevents the shaft from being rotated.

In another embodiment of the present invention, the latching assembly includes a handle for actuating the shaft where the handle is readily attachable to and detachable from the shaft. Once the door has been locked, the handle is easily detached from the shaft. This tends to secure the dryer since the handle is necessary to open the door. In one embodiment, the handle includes an end portion that includes two opposed grippers that are sized, shaped and generally configured to easily slip into one or more slots formed in the surface of the shaft. Once in the slot, the grippers can be manipulated to assume a gripping position. Once in the gripping position, the handle can be moved, causing the shaft to turn between locked and unlocked positions.

Other objects and advantages of the present invention will become apparent and obvious from a study of the following description and the accompanying drawings which are merely illustrative of such invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a side elevational view of a drying system including a dryer.

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FIG. 1A is a cross-sectional view of the dryer.

FIG. 2 is an enlarged view of the area referred to in FIG. 1.

FIG. 3 is a fragmentary side elevational view showing a portion of the latch assembly associated with two doors on the dryer.

FIG. 4 is a fragmentary perspective view showing portions of the latch assembly located about the lower portion of two doors on the dryer.

FIG. 5A is a perspective view showing a portion of the latch assembly disposed in the locked configuration.

FIG. 5B is similar to FIG. 5A but showing the latch assembly being moved to the unlocked position.

FIG. 6 is a plan view of a bracket and locking member that forms a part of the door latch assembly.

FIG. 7A is a top elevational view showing an elongated shaft extending through the bracket and locked in position.

FIG. 7B is a view similar to FIG. 7A but showing the shaft in an unlocked position.

FIG. 8A is a side elevational view showing the bracket and an associated locking member.

FIG. 8B is similar to FIG. 8A but showing the locking member in an inclined position.

FIG. 9 is a fragmentary elevational view showing portions of a series of door latch assemblies.

FIG. 10 is a perspective view of an alternative embodiment for the locking member where the locking member is provided with relief areas formed therein.

FIG. 11A is a partial sectional view illustrating the handle being inserted into slots formed in the shaft of the latch assembly.

FIG. 11B is similar to FIG. 11A except that the handle is actually engaged with the shaft of the latch assembly.

**DESCRIPTION OF EXEMPLARY EMBODIMENTS**

With further reference to the drawings, the dryer of the present invention is shown therein. In FIG. 1, a drying system, indicated generally by the numeral 100, is shown. Drying system 100 includes a dryer or drying section, indicated generally by the numeral 100A, and a cooler or cooling section 100B. Dryer 100A is a commercial or industrial dryer that is utilized to dry a wide variety of products, particularly food products such as cereals, grains, fruits and vegetables, as well as animal feed. Details of the dryer 100A are not dealt with herein because such is not per se material to the present invention and because dryers of the type shown in FIGS. 1 and 1A and discussed herein are well known and appreciated by those skilled in the art.

This disclosure focuses on a latch assembly for latching doors of the dryer in a closed position. However, before proceeding with a discussion concerning the latch assembly, a brief discussion of the dryer shown in FIGS. 1 and 1A is in order. Dryer 100A, in this example, comprises a housing structure that includes a roof 102 and a floor structure. See FIG. 1A. Further, the housing of the dryer includes a series of doors indicated by the numeral 106 and hinged to the dryer. As seen in the drawings, there are upper doors and lower doors. Opposed ends of the dryer 100A are generally closed.

Formed internally within the dryer 100A is a drying or conditioning chamber 108. Drying or conditioning chamber 108 includes a conveyor assembly 110 which is operative to move product through the drying chamber 108 during the drying process. Dryer 100A also includes a system for generating and circulating a system of heated or conditioned air through the dryer. In this regard, disposed about an upper side portion of the dryer 100A is a burner unit 112. Disposed

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adjacent the burner unit **112** is a filtered air inlet. Disposed across from the burner unit **112** is an air circulating fan assembly **116**. As illustrated in FIG. 1A, the burner unit **112** generates heat and heats a system of air that moves across the burner unit and through an upper plenum **124** of the dryer. As shown in FIG. 1A, heated air moves downwardly through the drying chamber **108**. Once in the drying chamber **108**, the heated air moves downwardly through the conveyor assembly **110** and at the bottom of the dryer the heated air turns to the right and, as viewed in FIG. 1A, moves into a right plenum **120**. From the right plenum **120**, air moves upwardly and a portion of the air circulated through the dryer **100A** is exhausted. Another portion of the air is recirculated through the dryer **100A** in conventional fashion.

People skilled in the art understand that various flow patterns can be formed in dryers of the type shown in FIGS. 1 and 1A. More particularly, the dryer **100A** in some embodiments is designed to include a number of interchangeable panels that permit air flow to be directed in various directions through the drying chamber **108**. Thus, the air pattern through the drying chamber **108** can be varied or reversed by simply rearranging panels within the dryer **100A**. For example, in some cases, the heated air can be directed to a lower portion of the dryer and then upwardly through the conveyor assembly **110**. For a more complete and unified understanding of the basic structure, function and operation of conventional dryers of this type, one is referred to dryers manufactured and sold by Buhler Aeroglide Corporation, headquartered in Cary, N.C., U.S.A.

With further reference to the drawings, the drawings depict and show a series of latch assemblies for latching the doors **106** in a closed and locked position. In one embodiment, a latch assembly includes a pair of brackets mounted to a dryer door and a shaft rotatively mounted in the bracket or adjacent a portion of the bracket. A latch extends from the shaft for engaging a latch catch secured to the dryer so as to secure the door in a closed and locked position. The shaft and latch are rotatable between locked and unlocked positions. A locking cavity is formed in the shaft. A locking member is mounted to the bracket and moveable between a locked and an unlocked position. In the locked position, the locking member extends into a locking cavity formed in the shaft and maintains the shaft in the locked position which in turn maintains the dryer door in the closed and locked position. When in the unlocked position, the locking member is disengaged from the locking cavity in the shaft, permitting the shaft to be rotated from the locked position to the unlocked position. When the shaft and latch are rotated into a locked position, the latch engages a latch catch secured on the dryer.

Turning more particularly to the drawings and various embodiments, the latch assembly includes a bracket **202**. In this embodiment, each door is provided with two brackets **202**, an upper bracket and a lower bracket. See FIGS. 6-8B. Each bracket **202** includes a main body portion **202A**, and opening **202B** and a support arm or finger **202D**. Bracket **202** is secured to a dryer door **106**. In particular, the bracket **202** extends through a front panel of the door and is connected by weldment or other suitable means to an internal frame structure within the door. As noted above, each door is provided with an upper bracket and lower bracket. The bracket just discussed is utilized as an upper bracket. The lower bracket **202** is similar to that just described except that it includes a bifurcated section **202C**. See, for example, FIG. 6. As will be discussed later, the bifurcated section **202C** accommodates the locking member **210**.

Continuing to refer to the latch assembly, an elongated shaft **204** forms a part of the latch assembly. Shaft **204** is

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rotatively contained within the openings **202B** of the upper and lower brackets **202**. That is, the shaft **204** is rotatable within openings **202B**. There is provided means for retaining the shaft **204** within the openings **202B** of the upper and lower brackets. In the case of one embodiment, C-clips **205** are secured in rings or recesses formed in the shaft **204**. See FIG. 9, for example. In this case, note with respect to the upper doors that there is provided two C-clips **205** inserted onto the shafts **204** just below the brackets **202**. This prevents the shafts **204** from being moved upwardly with respect to the brackets **202**. Continuing to refer to FIG. 9, the shafts **204** are prevented from moving downwardly by a pair of C-clips **205** that are attached to the shafts **204** just above the upper brackets **202**. That is, the upper brackets **202** engage the clips **205** and prevent the shafts **204** from sliding downwardly through the brackets **202**.

At the upper and lower ends of each shaft **204**, there is provided a latch **206**. The latch **206** in this embodiment is in the form of a generally hook shape and is designed to engage a catch **208** that is secured to the dryer **100A** and projects outwardly therefrom adjacent the various latch assemblies. It is seen and appreciated from the drawings that the shafts **204** are rotatable back and forth between locked and unlocked positions. In FIG. 9, for example, the curve shaped hooks or latches **206** are engaged with the catch **208** and are effective to lock respective doors **106** to the dryer. See also FIG. 5A that shows the curve shaped latch **206** in the latched or locked position. FIG. 5B shows the latch **206** rotated away from the locked position.

The latch assembly described herein provides a mechanism for locking the dryer doors **106** and, in accomplishing that function, the latch assembly is designed to lock the respective shafts **204** in a locked position. This is achieved by providing a locking mechanism that is associated with the lower disposed brackets **202**. With reference to FIG. 6-8B, note that there is provided a locking member **210** that is pivotally connected to the lower disposed brackets **202**. Locking member **210** is disposed in a voided area between the bifurcated section **202C**. See FIG. 6, for example. Locking member **210** is pivotally connected to a pivot pin **212** that extends through the bifurcated section of **202C** of the bracket **202**. As seen in FIGS. 8A and 8B, the locking member **210** is rotatable from a generally horizontal position (FIG. 8A) counterclockwise to an inclined position (FIG. 8B). In order to lock the shaft **204**, the shaft **204** is provided with a locking cavity **204A** formed therein. See locking cavity **204A** shown in FIG. 7B. Locking cavity **204A** is designed to receive the outer terminal end of the locking member **210** when the locking member assumes the horizontal locked position shown in FIG. 7A. That is, in the locked position, the locking member **210** projects into the locking cavity **204A** and since the bracket **202** is stationary, this prevents the shaft **204** from rotating in the opening **202B** of the bracket **202**.

In FIG. 9, there is shown an example of how a series of latch assemblies can be employed on the dryer **100A**. Shown therein is the lower portion of an upper set of doors **106** and the upper portion of a lower set of doors **106**. Note that one catch **208** is utilized for all four latches **206** shown in FIG. 9. Note the slight differences in the upper and lower disposed brackets **202**. Brackets **202**, disposed about the lower portions of the doors, include the locking member **210**. The locking cavity **204A** is formed in the shaft **204** adjacent the lower brackets. Brackets **202** disposed about the upper portion of the doors do not, in this embodiment, include the locking member **210**.

As illustrated in the drawings, the latch assembly discussed herein includes a detachable handle **300**. Handle **300** is

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designed to be readily detachable to the shaft **204** in order to turn and rotate the shaft **204** between locked and unlocked positions. The term detachably connectable or securable to the shaft **204** means that the handle **300** is not permanently fixed to the shaft or is not secured to the shaft by conventional securement means such as bolts, screws, rivets, weldment, etc. Being detachably secured means that the handle can be slipped onto and off of the shaft quickly and easily without having to unfasten any securement devices.

With reference to FIGS. **11A** and **11B**, the handle **300** is shown therein and includes a main section or main body **302**. Formed about a terminal end portion of the handle **300** is a jaw **304** that includes a pair of opposed grippers **306**. As seen in the drawings, the grippers **306** are designed to slip onto the shaft **204** and to grip the shaft such that it can be turned. To accommodate the handle **300**, the shaft **204** is provided with a slot structure for receiving the grippers **306** of the handle. In the case of the embodiments shown herein, the shaft includes two slots, with each slot being referred to by the numeral **204B**. It is appreciated that a single slot structure could be provided. In the case of the slot structure described herein, the slot includes a horizontal segment **204B1**. See FIG. **4**. Extending from the horizontal segment **204B1** is a vertical segment **204B2**. The design of the handle **300** is such that the grippers **306** are sized, spaced and shaped such that they can slide horizontally through the horizontal section **204B1** until the grippers reach the vertical segment **204B2**. Once reaching the vertical segment **204B2**, the grippers **306** are moved downwardly into the vertical segments where the grippers can now grip and rotate the shaft **204**. Note in FIG. **11A** where the distance between the inside surfaces of the grippers **306** is essentially the same as the distance between the internal side of the horizontal segment **204B1**. In similar fashion, the width of the grippers **306** is designed to fit in the vertical segments **204B2**.

It follows that after the handle **300** has been used to rotate the shaft **204** that the handle can be easily removed from the shaft. In the case of the embodiment illustrated in FIGS. **11A** and **11B**, the grippers **306** can be moved upwardly in the vertical segments **204B2** until the grippers reach the horizontal segment **204B1**, after which the grippers can simply be pulled horizontally from the shaft **204**.

Thus, in one embodiment, the present invention entails a handle detachably securable to the shaft such that the handle can be readily attached to and detached from the elongated shaft that forms a part of the latch assembly. The shaft includes a surface and at least one slot formed in the surface of the shaft for receiving a portion of the handle. The handle is configured to be inserted into the slot formed in the surface of the shaft such that, when inserted, the handle grips the shaft and the shaft can be rotated between the locked and unlocked positions by the handle. In one particular embodiment, the slot includes a horizontal segment and one or more vertical segments. In this embodiment, the terminal end portion of the handle is inserted into the horizontal segment and thereafter vertically into the vertical segment where the handle can grip the shaft such that the shaft can be turned back and forth between the locked and unlocked positions.

It is appreciated that when locking one of the dryer doors **106**, that by rotating the shaft **204** sufficient for the hook shaped latches **206** to engage the latch catches **208** that a resilient or deformable seal structure provided around the interface between the door and the dryer is compressed. Once the latches **206** are properly engaged with the catches **208**, the seal structure will provide a locking force on the latches **206**, causing them to be securely engaged and locked with the catches **208**. It follows that to unlock the doors sufficient force

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must be applied to the shafts **204** to overcome the locking pressure being exerted by the door seal structure.

The upper doors **106** of the dryer **100A** are designed to open in response to an explosion in the drying chamber **108**. Various approaches can be incorporated to enable the upper doors **106** to effectively automatically open in response to an explosion. In an alternative embodiment, the latch assemblies disclosed herein and used in connection with the upper doors **106** can be utilized to permit the upper doors to open in response to an explosion. See FIG. **10**. To achieve this function, the locking member **210** of the latch assembly is designed to fail in response to an interior explosion. In this embodiment, the locking member **210** includes opposed side surfaces. Each side surface of the locking member is provided with a relief area **210A**. These relief areas are designed into the locking member **210** to fail when a predetermined amount of force is transmitted from an upper dryer door through the shaft **204** to the locking member **210**. That is, the locking member **210** will break along the lines of the relief areas **210A**, enabling the associated upper door **106** to swing open.

The present invention may, of course, be carried out in other ways than those specifically set forth herein without departing from essential characteristics of the invention. The present embodiments are to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. A dryer for drying a product, comprising:

- a housing;
- a drying chamber formed in the housing of the dryer;
- a burner unit for heating air used to dry the product;
- a fan for circulating heated air through the drying chamber;
- one or more doors moveably mounted on the dryer and moveable between open and closed positions;
- at least one latch catch connected to the dryer adjacent the door;
- a bracket mounted to the door;
- a shaft rotatively mounted adjacent a portion of the bracket;
- a latch extending from the shaft for engaging the latching catch and securing the door in the closed position;
- the shaft and latch being rotatable between a locked position and an unlocked position;
- a locking cavity formed in the shaft;
- a locking member moveably mounted to the bracket and moveable between a locked position and an unlocked position;
- wherein in the locked position the locking member extends into the locking cavity formed in the shaft and maintains the shaft in the locked position which in turn maintains the door in the closed position; and
- wherein in the unlocked position the locking member is disengaged from the locking cavity in the shaft, permitting the shaft to be rotated between the locked and unlocked positions.

2. The dryer of claim 1 wherein the shaft is rotatable in the bracket.

3. The dryer of claim 1 wherein the locking member includes a relief formed therein that permits the locking member to fail in the event of an explosion in the dryer.

4. The dryer of claim 3 wherein the locking member includes two opposed surfaces and wherein the relief formed in the locking member includes two opposed channels formed in the two surfaces.

5. The dryer of claim 1 including a detachable handle configured to be readily attached to and detached from the shaft such that the handle is attachable to the shaft for opening

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and closing the door and wherein the handle is not attached to the shaft when the door is in the closed position and the shaft is in the locked position.

6. The dryer of claim 1 wherein the shaft includes at least one slot for receiving a portion of a detachable handle; and wherein the detachable handle is configured to be inserted into the slot such that the handle can turn the shaft between the locked and unlocked positions.

7. The dryer of claim 6 wherein the handle includes a terminal end portion that includes a jaw having at least two spaced apart grippers configured to fit into the slot formed in the shaft.

8. The dryer of claim 1 wherein:

the bracket includes a round opening for receiving the shaft and wherein the shaft is rotatable in the opening; and wherein the locking member is pivotally mounted on a pin extending through a portion of the bracket and pivotable thereabout between the locked and unlocked positions.

9. The dryer of claim 8 wherein the bracket includes a main body that includes the round opening for receiving the shaft and wherein the locking member is pivotally mounted to the main body.

10. The dryer of claim 9 wherein the main body of the bracket includes a bifurcated section and wherein the locking member is pivotally mounted on a pin that extends through a space formed by the bifurcated section.

11. The dryer of claim 1 wherein the locking member is rotatable about a pin extending through a portion of the bracket and wherein the locking member is rotatable from a generally horizontal position where the locking member extends into the locking cavity in the shaft to a position where the locking member is rotated out of engagement with the locking cavity in the shaft.

12. The dryer of claim 9 wherein the bracket further includes a support finger extending from the main body through an outer surface of the door.

13. A dryer for drying a product, comprising:

a housing;

a drying chamber formed in the housing of the dryer;

a burner unit for heating air used to dry the product;

a fan for circulating heated air through the drying chamber;

one or more doors moveably mounted on the dryer and moveable between open and closed positions;

a latching assembly for latching the door to the dryer;

the latching assembly including an elongated shaft mounted on the door and having at least one latch extending therefrom for engaging a latch catch mounted on the dryer;

the elongated shaft and latch being rotatable between locked and unlocked positions and in the locked position the latch extending from the elongated shaft engages the latch catch and locks the door in the closed position;

a handle detachably securable to the shaft such that the handle can be readily attached to and detached from the elongated shaft;

the shaft having a surface and at least one slot formed in the surface of the shaft for receiving a portion of the handle; the handle configured to be inserted into the slot formed in the surface of the shaft such that when inserted the handle grips the shaft and the shaft can be rotated between the locked and unlocked positions by the handle;

wherein the slot includes a generally horizontal segment and a generally vertical segment that is communicatively connected with the horizontal segment; and

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wherein the handle is configured to be inserted into the horizontal segment and to move therein to a point where the handle then moves vertically through the vertical segment where the handle can grip and rotate the shaft; and wherein the handle is configured to move vertically through the vertical segment to a point where the handle reaches the horizontal segment at which time the handle can be moved through the horizontal segment and from the shaft.

14. The dryer of claim 13 wherein the handle includes a C-shaped jaw formed on an outer end portion of the handle; and wherein a portion of the C-shaped jaw is configured to be inserted into the slot.

15. The dryer of claim 13 wherein the handle includes two spaced apart grippers for engaging the slot formed in the surface of the shaft; and wherein the handle is engaged with the shaft by inserting the grippers into the horizontal slot and moving the grippers vertically into the vertical segment.

16. The dryer of claim 13 wherein the detachable handle comprises an elongated member having a generally C-shaped jaw formed on one end portion thereof; and wherein the jaw includes two generally opposed grippers that project inwardly towards each other and wherein the grippers are sized, shaped and disposed with respect to each other to engage the slot formed in the surface of the shaft to enable the handle to rotate the shaft between the locked and unlocked positions.

17. The dryer of claim 13 wherein the shaft includes a locking cavity formed therein; and wherein there is a bracket mounted to the door and wherein a locking member is moveably mounted to the bracket and moveable between a locked position and an unlocked position; and wherein in the locked position the locking member extends into the locking cavity formed in the shaft and maintains the shaft in the locked position, which in turn maintains the door in a closed position.

18. A dryer for drying a product, comprising:

a housing;

a drying chamber formed in the housing of the dryer;

a burner unit for heating air used to dry the product;

a fan for circulating heated air through the drying chamber;

one or more doors moveably mounted on the dryer and moveable between open and closed positions;

a latching assembly for latching the door to the dryer;

the latching assembly including an elongated shaft mounted on the door and having at least one latch extending therefrom for engaging a latch catch mounted on the dryer;

the elongated shaft and latch being rotatable between locked and unlocked positions and in the locked position the latch extending from the elongated shaft engages the latch catch and locks the door in the closed position;

a handle detachably securable to the shaft such that the handle can be readily attached to and detached from the elongated shaft;

the shaft having a surface and at least one slot formed in the surface of the shaft for receiving a portion of the handle; the handle configured to be inserted into the slot formed in the surface of the shaft such that when inserted the handle grips the shaft and the shaft can be rotated between the locked and unlocked positions by the handle;

wherein the shaft includes a locking cavity formed therein; wherein there is a bracket mounted to the door and wherein a locking member is moveably mounted to the bracket and moveable between a locked position and an unlocked position; and

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wherein in the locked position the locking member extends into the locking cavity formed in the shaft and maintains the shaft in the locked position, which in turn maintains the door in a closed position.

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